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CONTRIBUTIONS TO THE OAK FLORA OF CENTRAL AMERICA

Cornelius H. Muller

Recent botanical exploration in the Central American republics has emphasized the incompleteness of our knowledge of the oak flora of that region. As pointed out in "Additions to the Oak Flora of El Salvador" (Tucker, John M., and Cornelius H. Muller, Madroño 8: 111–117. 1945), a collection of twenty-three numbers necessitated considerable change in some of the concepts embodied in "The Central American Species of Quercus" (Muller, Cornelius H., U.S.D.A. Misc. Publ. 477: 1–216. 124 pl. 1942). More recently additional specimens from Honduras, Guatemala, Costa Rica, and El Salvador have revealed an unexpected wealth of information on the oaks of these countries. It had been thought that the floras of Guatemala, Honduras, and Costa Rica were fairly well known, while El Salvador and Nicaragua were admittedly poorly represented in collections.

The recent field work of Dr. Louis O. Williams and his associates (notably Antonio Molina R.) at the Escuela Agrícola Panamericana, Tegucigalpa, Honduras, has yielded some seventy-five collections of *Quercus* made in Honduras as well as a similar quantity in Guatemala and Costa Rica. It is significant that the most interesting plants were found at high elevations beyond those usually reached by earlier collectors. In Honduras the principal novelties were found in cloud forest areas on two peaks in the Departmento de Morazán, one above and southwest of San Juancito and the other on Mount Uyuca. Dr. Williams has expressed the opinion (in correspondence with the author) that it is not very likely that the collection of the oak flora of Honduras will be "even approaching completion for some years to come" because of the great number of isolated mountains that are difficult to reach.

The degree of apparent endemism exhibited by some of the cloud forest species in Honduras is truly remarkable. The two localities mentioned above occupy peaks of similar elevation (about 2,000 m.) only about twenty-five kilometers apart. On both peaks cloud forest is well developed over small areas, but only five species of *Quercus* are known to be common to the two localities, namely *Q. aáata* C. H. Mull., *Q. pacayana* C. H. Mull., *Q. eugeniaefolia* Liebm., *Q. trichodonta* Trel., and one undescribed species. In addition Mount Uyuca yielded *Q. oocarpa* Liebm., while in the San Juancito locality were found two new species. The degree of distinctness of two of the novelties is quite unusual. If equally distinct narrow endemics may be expected in similar proportions on the other peaks of cloud forest elevation, the com-

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plete exploration of the Central American oak flora has only begun.

The number of novelties and significant extensions of range thus far encountered in Dr. Williams' collections seem to justify a review of the Honduran species at this time. All but six of the species previously known from Honduras are here treated. These six are *Q. Pilarius* Trel., *Q. corrugata* Hook., *Q. segoviensis* Liebm., *Q. tristis* Liebm., *Q. Skinneri* Benth., and *Q. tenuiaristata* Trel., all of them species of moderate elevations, chiefly in the Departmento de Comayagua. Included also are isolated records from Guatemala, El Salvador, and Costa Rica.

The author is deeply indebted to Dr. Williams for the privilege of studying his collections and for his generous cooperation in making repeated visits to the principal localities at the author's request.

The specimens cited are deposited in the herbarium of the author except where otherwise indicated; duplicates have been retained in the herbarium of the Escuela Agrícola Panamericana at Tegucigalpa, Honduras. Duplicate specimens of almost all of the numbers cited are to be found also in the herbaria of the Chicago Natural History Museum and the Arnold Arboretum.

Subgen. Lepidobalanus (Endl.) Oerst.

Quercus insignis (?) Mart. and Gal., Bull. Acad. Brux. 10^1: 219. 1843.

This species is here tentatively reported for the first time from Honduras and Costa Rica. It has previously been described as "occasional" in the British Honduras—Guatemala boundary region and more common in the southern Sierra Madre Oriental of Mexico, whence it was originally collected in Vera Cruz. Few species of *Quercus* bridge the Isthmus of Tehuantepec, all of them the "tropical" species of the lowlands of the Atlantic slope. It is possible that the sterile specimens here cited represent some other species, but they belong to no species previously known in these areas.

Honduras. Dept. Comayagua: a single tree 42 m. tall, bole 1.2 m. above buttresses, along Rio Tepemechin near Lake Yojoa, altitude 600 m., August 2, 1947, *Shank 12822*.

Costa Rica. Prov. Puntarenas: tree 27 m. with shaggy bark, Agua Buena, altitude 1100 m., January 24, 1948, *Shank 13954*.

Quercus tomentocaulis sp. nov. Arbor usque ad 80 m. alta; ramuli 2–4 mm. crassi dense fulvo-tomentosi; stipulae persistentes; folia tarde decidua, chartacea, 8–14 cm. longa, 2–5 cm. lata, oblanceolata vel anguste elliptica apice acuta basi cuneata vel rotundata crenata supra sparse villosa vel glabrata subtus villosa costis utrinque fulvo-tomentosa, venis utrinque 12–16 supra impressis subtus prominentibus; petioli 5–7 mm. longi, dense fulvo-tomentosi.

Tree to 80 m. (!) tall; twigs 2 to 4 mm. thick, coarsely fluted, densely yellow- or fulvous-tomentose, persistently gray-tomentose the second season with lenticels not evident; buds not seen; stipules persistent until the second season, 7 or 8 mm. long, ligulate or somewhat spathulate, dorsally rather densely appressed-hirsute; leaves evergreen, rather thin and chartaceous, usually 8 to 12 or sometimes 14 cm. long, 2 to 4 or 5 cm. broad, broadly oblanceolate to narrowly elliptic, cuneate to narrowly rounded or rarely broadly rounded at base, apically somewhat attenuate, regularly antrorsely crenately low-toothed except in the basal one-third, the teeth obscurely mucronate, margins somewhat crisped, moderately cartilaginous and slightly revolute (some leaves teratologically markedly revolute), upper surface dull green, sparsely villous with inconspicuous simple or few-rayed stellate hairs, promptly glabrate except the buff-tomentose midrib and the principal veins or a few hairs persistent on the blade, lower surface lighter green, persistently sparse-villous with mostly stellate hairs, especially on the veins, the midrib obviously tomentose; veins 12 to 16 on each side, very regular, branching and obviously anastomosing near the margin but ultimately passing into the teeth, somewhat impressed above but raised within the depressions, very prominent beneath (including also the reticulum); petioles 5 to 7 mm. long, densely fulvous-tomentose like the twigs and midribs; catkins and fruit not seen. (Pl. 9.)

Honduras. Dept. Morazán: cloud forest area, altitude 2000 m., mountains southwest of San Juancito, May 21, 1947, *Williams* and *Molina 12756* (type, in herbarium of the author; isotypes, in herbarium of the Escuela Agrícola Panamericana, Tegucigalpa); altitude 1800 m., February 20, 1948, *Williams* and *Molina 13725;* tree to 80 m. tall, rain forest, altitude 1800 m., north slope of Mount Uyuca between La Labranza, Tatunbla and Q. de Granadillo, November 4, 1948, *Molina 1431.*

Costa Rica. Prov. Cartago: timber tree cultivated by C. H. Lankester, Las Concavas, Cartago, March 7, 1948, *Williams* and *Molina 13803.*

Quercus tomentocaulis is similar in appearance to *Q. Davidsoniae* Standl. of Panamá and Costa Rica and to *Q. insignis* of México and British Honduras. The persistently tomentose twigs and persistent stipules of *Q. tomentocaulis* readily distinguish it from *Q. Davidsoniae.* From *Q. insignis* the species is distinguished by its shorter petioles, smaller leaves with usually more prominent teeth and pointed apices, and its stipules usually persisting more than one year. The openly dispersed spreading hairs of the lower leaf surface further characterize the species. Until flowering and fruiting characters are known, it is undesirable to assign *Q. tomentocaulis* with finality to any known series of species, but a relationship to *Q. Davidsoniae* and to *Q. insignis* may be suggested.

The discovery of the several specimens of *Q. tomentocaulis* ex-

plains the baffling polymorphy ascribed to *Q. Davidsoniae* (Muller, l.c., p. 20). In keying out *Q. Davidsoniae* it was necessary to place that species under both "twigs of the season persistently and densely fulvous-tomentose" and "twigs of the season glabrate or sparingly pubescent." The type (from Panamá) falls in the latter class, but at least some of the Costa Rican specimens are persistently tomentose. These latter should probably be included in *Q. tomentocaulis* which the Honduran specimens have demonstrated to be a recognizable entity. It should be noted also that the Costa Rican material cited under *Q. Davidsoniae* included some with leaves pubescent on the veins beneath. As the specimens are not now at hand, it is not possible to say if this pubescence is correlated with the persistence of twig tomentum. However, such variations are almost universally correlated in *Quercus*. Reference to persistent pubescence of twigs and veins should be deleted from the description of *Q. Davidsoniae*.

Quercus oocarpa Liebm. Overs. Danske Vidensk. Selsk. Forhandl. 1854: 184. 1854.

This is the second authentic collection of this species from Honduras, the first having been taken from the Departmento de Comayagua in 1936.

Honduras. Dept. Morazán: slender tree 7 m. tall, cloud forest, altitude 2000 m., Mount Uyuca, May 9, 1947, *Williams* and *Molina 12617*.

Quercus Molinae sp. nov. Arbor usque ad 10 m. alta; ramuli diametro 2 mm. pilis brevibus fulvo-tomentosi; stipulae persistentes; folia sempervirentia membranacea 12–21 cm. longa, 3–7 cm. lata, anguste oblanceolata apice attenuato-flagellata vel acuminata basi anguste rotundata ad apicem versus falcato-dentata utrinque costis strigosis exceptis glabrata; venis utrinque 10–14 supra impressis subtus prominentibus; petioli 2–3 mm. longi, strigosi.

Tree 10 m. tall; twigs about 2 mm. thick, obscurely fluted, persistently short buff-tomentose or sparsely so, the surface glaucous or gray; buds elongate, sparsely ciliate or glabrous, terminal buds not seen; stipules persistent, about 10 mm. long, ligulate, sparsely buff-tomentose dorsally; leaves persistent, very thin and membranous, 12 to 18 or even 21 cm. long, 3 to 5 or even 7 cm. broad, narrowly oblanceolate, very narrowly rounded at base, attenuately flagellate at apex, coarsely and falcately several-toothed above the middle, margins minutely cartilaginous and strigosely sparse-ciliate, upper surface dull green and glabrous except for the sparsely strigose midrib, the principal veins rarely strigose, lower surface similar except for occasional axillary tufts, the midrib and veins more definitely strigose; veins 10 to 14 on each side, branching and obscurely anastomosing but passing into the teeth where these are present, slightly impressed above, rather prom-

inently raised beneath; petioles 2 to 3 mm. long, strigose or dorsally glabrous and dark brown; catkins and fruit not seen. (Pl. 10.)

HONDURAS. Dept. Morazán: cloud forest area, altitude 2000 m., mountains southwest of San Juancito, May 21, 1947, *Williams* and *Molina 12753* (type, in herbarium of the author; isotypes, in herbarium of the Escuela Agrícola Panamericana, Tegucigalpa).

It is a pleasure to name this species in honor of Antonio Molina R., one of the collectors who assembled this important collection of plants.

Quercus Molinae is clearly related to *Q. aáata* but differs in the shape, thin texture, and marked toothing of its leaves and the much greater prominence of its twig pubescence. In general appearance *Q. Molinae* is much like *Q. Pilarius* Trel., but it is amply distinguished from that species by its exceedingly thin leaf blades with midribs and veins clearly strigose even in age and its persistently appressed tomentose twigs. From *Q. oocarpa* the new species may be distinguished by its entirely glabrate lower leaf surface, its less copious pubescence, and its narrower leaves with attenuate apices.

The excessively attenuate development of the leaf apices forms "drip tips" in *Q. Molinae* even more pronounced than those described in *Q. esesmilensis* (Tucker and Muller, l.c., p. 117) and clearly bears out the collectors' designation of the habitat as "cloud forest".

QUERCUS COPEYENSIS C. H. Mull., U.S.D.A. Misc. Publ. 477: 30. 1942.

Although *Q. copeyensis* has previously been known only from Costa Rica and Panamá, the species may now be recorded from Honduras. The Honduran material greatly clarifies the specific limits of the species by offering mature fruit and by exhibiting variations in leaf size and shape that clearly link to this species some anomalous specimens from Costa Rica that were reluctantly referred to *Q. aáata* (Muller, l.c., p. 27, 28, pl. 25).

In a recent paper, Little (Carib. For. 9: 345–353. 1948) called attention to these atypical specimens of *Q. aáata* and suggested their transfer to *Q. copeyensis*. He further offered an emended description of *Q. copeyensis* to accommodate the large-leafed form. The removal of these specimens from *Q. aáata* leaves that species homogeneous in form from Guatemala to Costa Rica, while their inclusion in *Q. copeyensis* is easily justified by the large series of specimens now available.

HONDURAS. Dept. Morazán: tree 8 (15) m. tall, cloud forest area, mountains southwest of San Juancito, altitude 2000 m., May 21, 1947, *Williams* and *Molina 12759;* November 6, 1947, *Williams* and *Molina 13342, 13344, 13357;* February 20, 1948, *Williams* and *Molina 13697;* tree 20 m., cloud forest on Mount Uyuca, altitude 2000 m., August 7, 1947, *Molina 465.*

Costa Rica. Prov. Alajuela: Palmira, June 11, 1941, *Smith 2756;* July 1, 1941, *Smith 2879.* Prov. Heredia: Cerro de las Caricias, north of San Isidro, March 11, 1926, *Standley* and *Valerio 52178.* Prov. Cartago: tree 6 × 120 ft., dominant of temperate rain forest, altitude 8300 ft. along the continental divide, Cordillera de Talamanca, 36 mi. south of Cartago, February 16, 1943, *Little 6002, 6004, 6008;* tree 8 m. tall, in barranco, altitude 2800 m., slopes of Volcán Irazú, near San Rafael de Cartago, March 14, 1948, *Williams* and *Molina 13845;* tree 25 m. tall, altitude 2900 m., slopes of Volcán Irazú near Hotel Roberts, March 14, 1948, *Williams* and *Molina 13854.*

Quercus aáata C. H. Mull., U.S.D.A. Misc. Publ. 477: 27. 1942.

One collection of *Q. aáata* from the vicinity of San Juancito, Honduras, was made in 1932.

Honduras. Dept. Morazán: tree 5 m. tall, cloud forest, altitude 2000 m., Mount Uyuca, May 9, 1947, *Williams* and *Molina 12634;* tree 8 to 30 m. tall, cloud forest area, altitude 2000 m., mountains southwest of San Juancito, May 21, 1947, *Williams* and *Molina 12758, 12782, 12796;* March 25, 1948, *Williams* and *Molina 13770, 13974, 13975, 13985.*

Quercus polymorpha Schl. and Cham., Linnaea 5: 78. 1830.

This species has not previously been reported south of Guatemala where it is rather widespread but apparently not abundant. Its greatest development occurs in central and northeastern México.

Honduras. Dept. Morazán: tree to 20 m., in canyon, altitude 1000 m., between Talanga and Izotes, April 1, 1947, *Williams* and *Molina 12278.*

Quercus oleoides Schl. and Cham., Linnaea 5: 79. 1830.

Although frequently collected in Honduras, this species has not previously been encountered in the Departmento de Morazán. It is quite common in Honduras in dry valleys and on dry hills, principally between 800 and 1000 m. elevation. The species is a fair indicator of elevation, although it occurs both above and below the altitudes mentioned.

Honduras. Dept. Morazán: tree 4 to 10 m. tall, dry rocky hillside, altitude 850 m., oak-pine forest 2 km. northwest of Zamorano, July 19, 1946, *Williams* and *Molina 10046* and *10054;* tree 15 m. tall, along San Antonio road, October 21, 1946, *Shank 10782;* tree 5 m. tall, pine-oak forest, altitude 1200 m. at Agua Amarilla, December 1, 1946, *Williams* and *Molina 11030.*

Subgen. Erythrobalanus (Spach) Oerst.

Quercus hondurensis Trel., Mem. Nat. Acad. Sci. 20: 140. 1924.

This species is widely distributed in Honduras but is here re-

ported for the first time from the Departmento de Morazán, where the collectors inform me it is very common at about 1000 to 1500 m. elevation.

HONDURAS. Dept. Comoyagua: tree 5 m. tall, pine forest, altitude 1400 m., mountains above Flores, April 8, 1947, *Williams* and *Molina 12301.* Dept. Morazán: tree 15 m., pine-oak forest, altitude 1500 m., near Hoya Grande, August 17, 1947, *Williams* and *Molina 13275.*

QUERCUS YOROENSIS Trel. in Yuncker, Field Mus. Publ., Bot. Ser. 9: 282. 1940.

This species was reduced to synonymy under *Q. hondurensis* (Muller, l.c., p. 49) because the single collection upon which the typical form of *Q. yoroensis* was based seemed to be only a leaf variant of *Q. hondurensis. Quercus yoroensis* var. *aguana* Trel. in Yuncker (l.c.) was likewise based upon a single collection and exhibited a leaf shape more similar to *Q. hondurensis.* This seemed to add weight to the conclusion of synonymy. An additional four collections taken at some distance from the type locality and exhibiting quite constantly the differences upon which *Q. yoroensis* may be distinguished from *Q. hondurensis* make their separation imperative.

The relationship of *Q. yoroensis* to *Q. hondurensis* is obvious in the small annual fruit, the persistently tomentose twigs, and the similar arrangement of the leaf pubescence in the two species. However, the smaller, broadly rounded leaves of *Q. yoroensis* consistently distinguish that species from *Q. hondurensis.*

HONDURAS. Dept. Morazán: tree 5–10 m., oak-pine forest, dry rocky hillside, altitude 850 m., 2 km. northwest of Zamorano, July 11, 1946, *Williams* and *Molina 10047;* July 19, 1946, *Williams* and *Molina 10069;* tree 10 m., pine-oak forest, altitude 1500 m., near Lo de Ponce, February 20, 1948, *Williams* and *Molina 13745.* Dept. El Paraíso: tree 5 m., pine-oak forest, altitude 1400 m., in vicinity of Manzaragua, April 4, 1948, *Williams* and *Molina 14006.*

QUERCUS SAPOTAEFOLIA Liebm., Overs. Danske Vidensk. Selsk. Forhandl. 1854: 185. 1854.

Typical specimens of this species are not common among Honduran collections. The species has previously been reported but once from the Departmento de Morazán, although it is said to be quite abundant in some places there.

HONDURAS. Dept. Comayagua: tree 5 m. tall, pine forest, altitude 1400 m., mountains above Flores, April 8, 1947, *Williams* and *Molina 12300;* tree 15 m. tall, altitude 870 m., slopes of mountain above Flores, April 8, 1947, *Williams* and *Molina 12310.* Dept. Morazán: tree 3 to 15 m. tall, rocky slopes, altitude 1550 m., in oak-pine forest near Hoya Grande, July 14, 1946, *Williams* and *Molina 10039;* tree 10 m. tall, altitude 1500 m., in oak-pine woods above Hoya Grande, May 11, 1947, *Williams* and *Molina 12668.*

QUERCUS AMISSAELOBA Trel. in Yuncker, Field Mus. Publ., Bot. Ser 17: 357. 1938.

In an earlier treatment (Muller, l.c., p. 53) this species was reduced to synonymy under *Q. sapotaefolia* on the basis of its being a stump-sprout or a juvenile form with "scarcely two leaves of the same size and shape". The collection of identically the same polymorphic form at some distance from the type locality and the evidence of maturity and fruition observed by the collector require a reversal of that opinion. The irregular form of the leaves, their obscure lobing, and their usually acute apices serve to distinguish this species from *Q. sapotaefolia* to which it is obviously closely related. The species is quite common in oak-pine woods. It is a fair indicator of elevation.

HONDURAS. Dept. Morazán: slender tree to 15 m. tall, dense pine forest, altitude 1300 m., near Agua Amarilla, December 8, 1946, *Williams* and *Molina 11168*.

QUERCUS EUGENIAEFOLIA Liebm., Overs. Danske Vidensk. Selsk. Forhandl. 1854: 185. 1854.

This species has not previously been known north of Costa Rica. It is quite common in cloud forests in the Departmento de Morazán where, because of its great size and abundance, it is outstanding.

HONDURAS. Dept. Morazán: tree 5 to 10 m. tall, cloud forest, altitude 2000 m., Mount Uyuca, July 8, 1946, *Williams* and *Molina 10018;* May 9, 1947, *Williams* and *Molina 12635;* tree 35 m. tall, cloud forest, altitude 2000 m., mountains southwest of San Juancito, May 21, 1947, *Williams* and *Molina 12733;* November 6, 1947, *Williams* and *Molina 13336* and *13354;* February 20, 1948, *Williams* and *Molina 13702;* March 25, 1948, *Williams* and *Molina 13779;* tree 10 m. tall in oak-pine forest on La Montañita, altitude 1800 m., June 7, 1947, *Molina 40*.

QUERCUS BORUCASANA Trel., Mem. Nat. Acad. Sci. 20: 161. 1924.

This species has been known previously only from Costa Rica where it is confined to elevations above 1800 m. It may now be reported from Guatemala where it grows at elevations above 2100 m. The recurrence in Guatemala of the clearly typical form of *Q. borucasana* aids materially in maintaining this problematic species.

GUATEMALA. Dept. Zacapa: tree 30 to 40 ft. tall, near summit of Volcán Gemelos, Sierra de las Minas, January 26, 1942, *Steyermark 43300* (Herb. Chicago Nat. Hist. Mus.). Dept. Huehuetenango: cloud forest on Cerro Canana, between Cuchumatanes and Canana, Sierre de los Cuchumatanes, July 18, 1942, *Steyermark 49034* (Herb. Chicago Nat. Hist. Mus.).

QUERCUS CRISPIFOLIA Trel., Mem. Nat. Acad. Sci. 20: 147. 1924.

This imperfectly known species is at present represented by

fragmentary type material from Chiapas, Mexico, and sterile collections from Guatemala. Extension of the range to El Salvador was anticipated (Muller, l.c., p. 32) on the basis of the reference of *Q. amphioxys* Trel. to synonymy under *Q. crispifolia*. Additional material from El Salvador strengthens the opinion that only one species is involved.

El Salvador. Dept. San Salvador: western slopes above Finca Florencia, altitude 1680 to 1890 m., Volcán San Salvador, January 31, 1946, *Carlson 412* (Herb. Univ. Calif. ex Field Museum); from Finca Las Brumas, altitude 1680 m., to the peak of the volcano, altitude 2010 m., Volcán de San Salvador, February 3, 1946, *Carlson 486* and *487* (Herb. Univ. Calif. ex Field Museum).

Quercus trichodonta Trel. in Yuncker, Field Mus. Publ., Bot. Ser. 17: 358. 1938.

This species was placed in synonymy under *Q. Skinneri* (Muller, l.c., p. 69) because the only known collection appeared to differ from typical *Q. Skinneri* only in its shorter petioles. Such a form occurs sporadically in the Mexican population of the species where it had been separated as *Q. chiapasensis* Trel. Several additional collections from Honduras now clearly indicate that *Q. trichodonta* is not merely a sporadic phenotype of *Q. Skinneri* and that it deserves specific rank. In addition to its leaf shape and short petioles, *Q. trichodonta* differs from *Q. Skinneri* in its tardily glabrate or persistently fulvous-tomentose twigs, petioles, and midribs and in its much smaller fruit maturing in one year. These characters were not evident in the type collection of *Q. trichodonta*.

The rather full series of specimens now at hand clearly connects *Q. gracilior* C. H. Mull. (l.c., p. 77) with *Q. trichodonta* under which it must be reduced to synonymy. The range of *Q. trichodonta* extends from 1000 to 2000 m. in elevation, a considerably greater difference than is ordinarily tolerated by *Quercus* species at this latitude.

Honduras. Dept. Morazán: tree to about 75 m., rain forest, altitude 2000 m., Mount Uyuca, August 20, 1946, *Williams* and *Molina 10392;* December 5, 1946, *Williams* and *Molina 11143a;* March 2, 1947, *Williams* and *Molina 12101;* May 9, 1947, *Williams* and *Molina 12636*. Dept. Santa Barbara: Montaña Santa Barbara, near Lake Yojoa, above Sauce, altitude 1000 m., August 7, 1948, *Williams* and *Molina 14521*. Dept. Comayagua: tree to 20 m., broad-leaf forest in barranco, altitude 1200 m., near Trincheras, April 30, 1947, *Williams* and *Molina 12550*.

Quercus acatenangensis Trel., Mem. Nat. Acad. Sci. 20: 163. 1924.

Although very abundant through much of Guatemala, *Q. acatenangensis* has not previously been reported from the Departmento de Sololá.

Guatemala. Dept. Sololá: tree 6 m., moist banks below Los Encuentros, altitude 2500 m., June 25, 1947, *Williams 13149*.

Quercus Lowilliamsi sp. nov. Arbor usque ad 40 m. alta; ramuli diametro 2–3 mm. pilis flavidis primo stellato-tomentosi demum glabrati; stipulae caducae; folia decidua coriacea 12–23 cm. longa, 3–6 cm. lata, anguste oblanceolata basi cuneata apice attenuato-acuta aristataque integra vel ad apicem versus aristato-dentata domatiis exceptis glabrata; venis utrinque 12–15 paulo prominentibus; petioli 7–12 mm. longi, glabrati; fructus annuus brevipedunculatus; cupula 12 mm. lata; squamae stricte appressae; glans 12 mm. longa, 10 mm. lata, subrotunda quarto longitudine in cupula inclusa.

Tree 40 m. tall; twigs 2 to 3 mm. thick, coarsely fluted, densely fulvous-tomentose, quickly glabrate or tardily so about the apex or in protected grooves, dull brown with inconspicuous lenticels, becoming russet the second season with numerous small prominent pale lenticels; buds tan-brown, fulvous-tomentose about the apex, otherwise glabrous and glossy (mature buds not seen); stipules promptly caducous; leaves deciduous, rather thick and coriaceous, 12 to 18 or even 23 cm. long, 3 to 5 or 6 cm. broad, narrowly oblanceolate, narrowed at both ends, basally cuneate or rarely narrowly rounded, attenuately acute and aristate at apex, aristately few-toothed about the apex or quite entire, upper surface dull dark green and glabrous, lower surface light green and glossy, glabrate except for tufts of fulvous tomentum in the axils of the principal veins, margins minutely cartilaginous; veins 12 to 15 on each side, sometimes with evanescent intermediates, branching widely and obviously anastomosing toward the margin, somewhat raised on both surfaces (including the reticulum) but quite prominent beneath; petioles 7 to 12 mm. long, at first fulvous-tomentose but soon glabrous like the twigs, dorsally flattened and winged by the decurrent blade; staminate catkins 3 to 4 cm. long, loosely flowered on a loosely tomentose peduncle, the anthers much exserted from the villous calyx; pistillate catkins densely fulvous-tomentose, 2- or 3-flowered on peduncles 5 or 10 mm. long, the young cups subcylindric, the scales densely fulvous-tomentulose; fruit annual, solitary or paired on stout peduncles about 3 mm. long, small; cups about 12 mm. in diameter, goblet-shaped with obviously constricted bases, scales tightly appressed, minutely gray-tomentulose except the strict brown glabrous margins; acorns about 12 mm. long, 10 mm. broad, subrotund, at first minutely silky-pubescent, tardily glabrate, light brown, about one-fourth included. (Pl. 11.)

Honduras. Dept. Morazán: cloud forest area at 1800 to 2200 m. altitude in mountains southwest of San Juancito, May 21, 1947, *Williams* and *Molina 12760* (type, in herbarium of the author; isotypes in herbarium of the Escuela Agrícola Panamericana,

Plate 9. Quercus tomentocaulis Muller (Williams and Molina 12756).

Plate 10. Quercus Molinae Muller (Williams and Molina 12753).

Plate 11 Quercus Lowilliamsi Muller (Williams and Molina 12760).

Tegucigalpa); November 6, 1947, *Williams* and *Molina 13325* (from which the fruit is described); February 20, 1948, *Williams* and *Molina 13701* and *13721;* March 25, 1948, *Williams* and *Molina 13782* (from which the catkins are described).

Quercus Lowilliamsi is a member of the series *Acutifoliae* Trel. and is apparently most closely related to *Q. conspersa* Benth. From this polymorphic species the proposed new species is distinguished by its densely tomentose twigs at vernation, its leaves markedly narrowed basally, the blades lacking in glandular puberulence beneath, and its annual fruition. In so large and intricately related a series as the *Acutifoliae,* it is not often that a species so abundantly distinct as *Q. Lowilliamsi* is encountered.

It is a pleasure to name this species in honor of Dr. Louis O. Williams in recognition of his excellent collection of Central American oaks and his generous cooperation in their study.

Quercus conspersa Benth., Pl. Hartw. 91. 1842.

This common Guatemalan species has previously been reported from Honduras, Departmento de Tegucigalpa (now Morazán). The specimen here cited from Hoya Grande is atypical in having entire leaves lacking any resinous puberulence on their lower surfaces, a common variation in the species as it occurs in Guatemala. A single such specimen was found.

Honduras. Dept. Morazán: tree 15 m. tall, pine-oak forest, altitude 1500 m. near Hoya Grande, August 17, 1947, *Williams* and *Molina 13276;* tree 10 m. tall, altitude 1500 m., lower slopes of Mount Uyuca, February 18, 1948, *Williams* and *Molina 13676.*

University of California,
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A NEW SPECIES OF CHENOPODIUM FROM MEXICO

Howard S. Reed

Chenopodium pueblense sp. nov. Herba erecta aliquanto farinosa 3–10 dm. alta e radice fibrata cauli saepe striato foliis pallide viridibus rhomboideo-ovatis vel deltoideis grosse dentatis venis prominentibus supra glabratis infra paulo farinosis apice acutis basi cuneatis 5–8 cm. longis 3–4 cm. latis inferioribus gradatim deciduis, petiolis gracilibus; floribus farinosis in spicis ramosis terminalibus vel in axillis foliorum superiorum glomeratis sepalis carinatis staminibus 5 vel 6 brevibus vix exsertis antheris flavis stylis duobus vel tribus exsertis seminibus sanguineis punctatis turbinato-complanatis. E civitate Puebla, Mexico. Nomine vulgari Cuahzontli.

Erect annual from a small, fibrous root system; stem 3–10 dm. high, sparsely farinose, often striate, the short branches ascend-

ing; leaves alternate, 5–8 cm. long, 3–4 cm. broad (figs. 2a, 2b, 2c), the petioles slender, usually shorter than the blades but often equal, the blades coarsely dentate, pale green, glabrate on the upper, finely farinose on the lower surface, rhombic-ovate to

FIG. 1. *Chenopodium pueblense* Reed: left, inflorescence; right, upper part of mature plants (Photo by D. T. MacDougal).

deltoid, the apex acute, the base cuneate, the lower teeth generally larger, making the blades sub-hastate, the veins prominent, the lower leaves progressively deciduous; leaves of the branchlets small, 1–2.5 cm. long, the margins dentate or repand; seedlings 8–10 cm. high, with leaves 2–3 cm. long, deep green, deltoid, repand, the apex blunt, sparsely farinose (fig. 2e); flowers glomerulate on terminal or axillary, branched spikes, all farinose (figs. 1, 2d); calyx-lobes carinate (fig. 2f) closely investing the fruit, copiously farinose; stamens 5 or 6, short, scarcely exserted, the anthers yellow; styles 2, occasionally 3, exserted (fig. 2f); seeds horizontal, flattened-turbinate, Acajon red (Ridgeway, pl. 13), diameter 1.3 to 1.1 mm., pericarp readily separable, the surface punctate, the elevated margin obtuse (fig. 2g), the embryo completely encircling the endosperm.

Type. Plant cultivated in Berkeley, California, from seed collected by Professor Carl O. Sauer, at Calpán, Puebla, Mexico, alti-

tude 2460 m., *H. S. Reed 2038,* May 6, 1948 (Herb. Univ. Calif. no. 794980).

The species seems not to occur outside of cultivation. Young plants are cooked and eaten as greens, the immature inflorescences, when the seeds are in the "milk" stage (fig. 1), are dipped in egg-

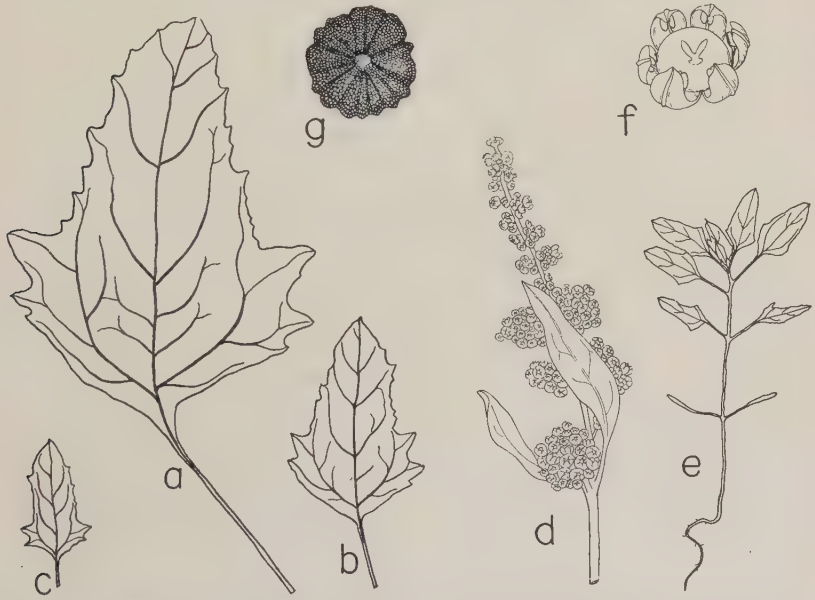

FIG. 2. *Chenopodium pueblense* Reed: *a,* basal leaf of mature plant, ×0.4; *b,* midstem leaf of mature plant, ×0.4; *c,* branchlet leaf of mature stem; *d.* terminal inflorescence showing glomerulate, branched spike; *e,* seedling; *f,* flower; *g,* seed, ×9.

batter and fried. The Aztec name *cauhzontli* is apparently derived from *cuauhtli* (or *quauhtli*), eagle and *tzontli,* hair of the head.

The vegetative characters of *C. pueblense* have certain resemblances to those of *C. Quinoa,* a plant cultivated for food in parts of South America. The seeds of the latter species however, are ivory white and larger than those of the former. The Aztec name it bears is strong evidence, moreover, that *C. pueblense* is indigenous to Mexico.

In 1947, Dr. D. T. MacDougal carried out several tests on the rate of swelling and germination of seed which had been grown in his garden at Carmel in the previous summer. The seeds, which had been stored for a few weeks at room temperature, germinated rapidly when placed on pieces of porous tile in a warm moist chamber. The red color of the seeds disappears during the early stages of germination. At the time of emergence of the cotyledons, the seed coats have lost all of the red color.

In an experiment which is typical of many others, 194 seeds were placed in a moist chamber at 32° C. One seed had germinated in four hours, 50 seeds in eight hours, and the entire lot in 48 hours. The importance of this power of rapid germination can be appreciated when one realizes that, in its habitat, rain falls in showers (often torrential) of a few hours' duration. If the seeds are on the ground where they can absorb water, they could germinate quickly and get established before the ground became too dry for successful growth.

A sample of seeds which Dr. D. T. MacDougal planted in 1946 at Carmel, California, produced numerous plants which matured seed. The following spring he planted some of the 1946 crop of seeds in his garden and produced a second crop. Among these plants was one which attained a height of 3.34 m. (10 feet, 11 inches). The chromosomes in seedlings derived from this plant were 2n = 36. I owe the determination to Dr. J. A. Jenkins. The plant appears to be a tetraploid.

I wish to express my gratitude to Mr. Charles L. Babcock who prepared the Latin description of the species.

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TAXONOMY AND EVOLUTION OF VASEYANTHUS

Howard Scott Gentry

Vaseyanthus is a small genus in the Cucurbitaceae endemic to the arid and semiarid California Gulf Region of northwestern Mexico. It is generically characterized by the conic ovary of one to three cells, one or two of which commonly abort to leave a one-seeded fruit. The androecium and the few, erect to ascending, ovules place *Vaseyanthus* in the tribe Sicyoideae as outlined by Cogniaux (1916, p. 1). The closest relation is with *Echinopepon* Naudin (1865, p. 17), by reason of the several-celled ovary with erect to ascending ovules, rather than with *Brandegea* Cogn. (1890) and *Sicyos* L. (1753, p. 1013), both of which have single-celled ovaries with one pendulous reflexed ovule. The genera *Marah* Kell. (1854) and *Echinocystis* Torr. & Gray (1840, p. 542), although usually thought of as being associated with this group of genera, appear not to be closely related because of their highly flexuous anthers of reduced number, hypogeous germination, and large round seeds. Generically *Vaseyanthus* is separated from its nearest relative, *Echinopepon,* by the globose body of the fruits with thick, indurate, vescicular pericarps, the reduced number of cells and ovules, and a strong tendency towards reduction in the number of stamens. This genus, as represented by four entities, exhibits a relatively mild state of specific development.

Weak speciation suggests a young genus, but this is not borne out by later considerations.

The genus was initiated by Alfred Cogniaux (1891), who based it on *Vaseyanthus Rosei,* a smooth-fruited oddity. Only the year before he had described *Echinocystis Brandegei,* defining by its characters a new section, *Pseudo-Echinopepon* (1890). Although the latter has an echinate fruit, it is certainly congeneric with *Vaseyanthus Rosei* and it is surprising that such a keen student of the Cucurbitaceae did not recognize the relationship. Doubtless, he was misled into forming a generic category by the unusual non-echinate fruits of the latter.

J. N. Rose (1897, pp. 119–120) made the next taxonomic moves by bringing *Echinocystis Brandegei* and *Echinopepon insularis* of Watson (1889, p. 51) into the genus. He failed, however, to recognize the congeneric position of *Echinopepon Palmeri* Wats. (l. c., p. 52) and relegated it to *Brandegea,* where it certainly does not belong.

I. M. Johnston (1924, pp. 1180–1182), with his series of collections, was the first to recognize the close relationships of the described species. He interpreted the lot as a monotypic genus with two varieties, *Brandegei* and *inermis,* under *Vaseyanthus insularis.* Unfortunately, however, he failed to identify his smooth-fruited variety, *inermis,* as Cogniaux's primary species, *V. Rosei.* Johnston placed *V. Rosei* in synonymy under *V. insularis Brandegei* (Cogn.) Jtn. Cogniaux, however, described the fruit as "laevis", and a photograph of the type in the Gray Herbarium (La Paz, *Palmer 102* in 1890) shows the typical non-echinate fruit. Since the first epithet for a given category must retain priority, Johnston's name stands and the type species is now properly a synonym under *V. insularis inermis* Jtn.

The selection of the echinate-fruited *Vaseyanthus insularis* as the varietal carrying name makes an unusual form of this complex stand as the type specimen. An isotype of *Vaseyanthus insularis* (*Palmer 409* in 1887 from San Pedro Martir Island) is an unusually coarse-stemmed and broad-leaved form with shallow leaf-lobing, apparently grown under unusually moist conditions or in the shade. Priority, however, again dictates its retention as an inclusive name for the complex.

The fruits of the genus are small, ranging from 8 to 15 mm. in diameter exclusive of the prickles, which are from 1 to 7 mm. long. The body of the fruit (fig. 1) is globose, or ellipsoidal (in case the upper ovule develops), or somewhat oblique (in case only one of the lateral basal ovules develops). The body of the fruit is capped with a prominent, smooth, tapering beak, persistent in some varieties, but tardily deciduous in others. The ovule is attached to the bottom of the cell by a short funicle at the base and is erect or nearly so. The smaller size of the upper ovule in *Vaseyanthus insularis* (Wats.) Jtn. (fig. 2) is indicative of

its strong abortive tendency. The stamens are united to form an androecium, but the anthers are distinct, varying in number from 3 to 5, and are deeply crescentic or horseshoe-shaped, the whole making a short compact column with the common connective hidden in the center.

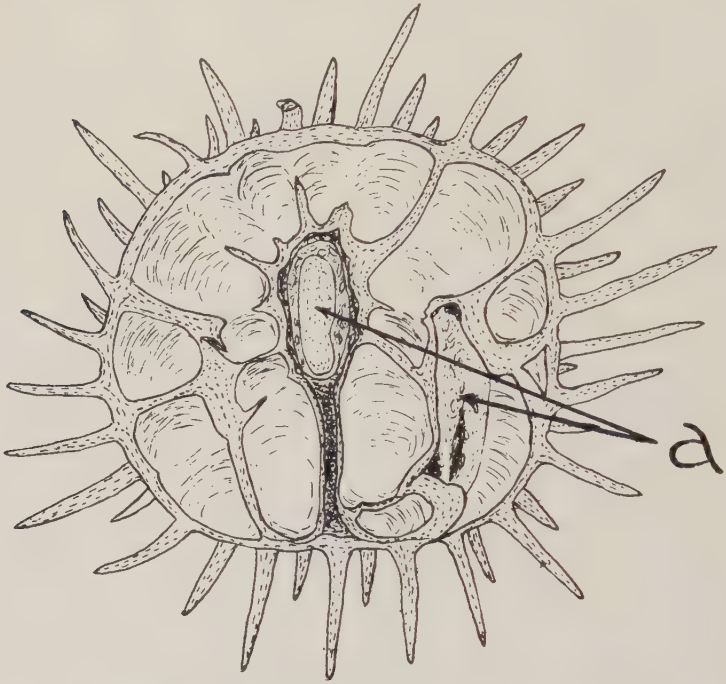

Fig. 1. Mature fruit of *Vaseyanthus Brandegei* (cross section): *a*, seeds in separate cells surrounded by empty vescicles. ×6.

In the following disposition of the variants, I have taken considerable pains to perceive reliable criteria for phenotypic segregation. I do not follow the tenet that morphologic intergradation *ipso facto* reduces closely related species to subspecific status or synonymy. I have attempted to segregate the variants according to phenotypic populations as expressed in two or more discernible and consistent morphological features. Where these features are strong, I have recognized species; where weaker, varieties. In making the segregations, I have also been influenced by the geographic, and more particularly by the physiographic, distributions of the *Vaseyanthus* populations. As will be demonstrated, the distributions corroborate the taxonomic segregates and have given assurance for the taxonomic definitions.

The most expressive features for taxonomic segregation of the populations are found in the characters of the following

organs:—(1) The fruits—whether they are echinate or smooth, the length, and, to a lesser degree, the density of their prickles; whether tardily dehiscent or not dehiscent; their sizes and shapes.

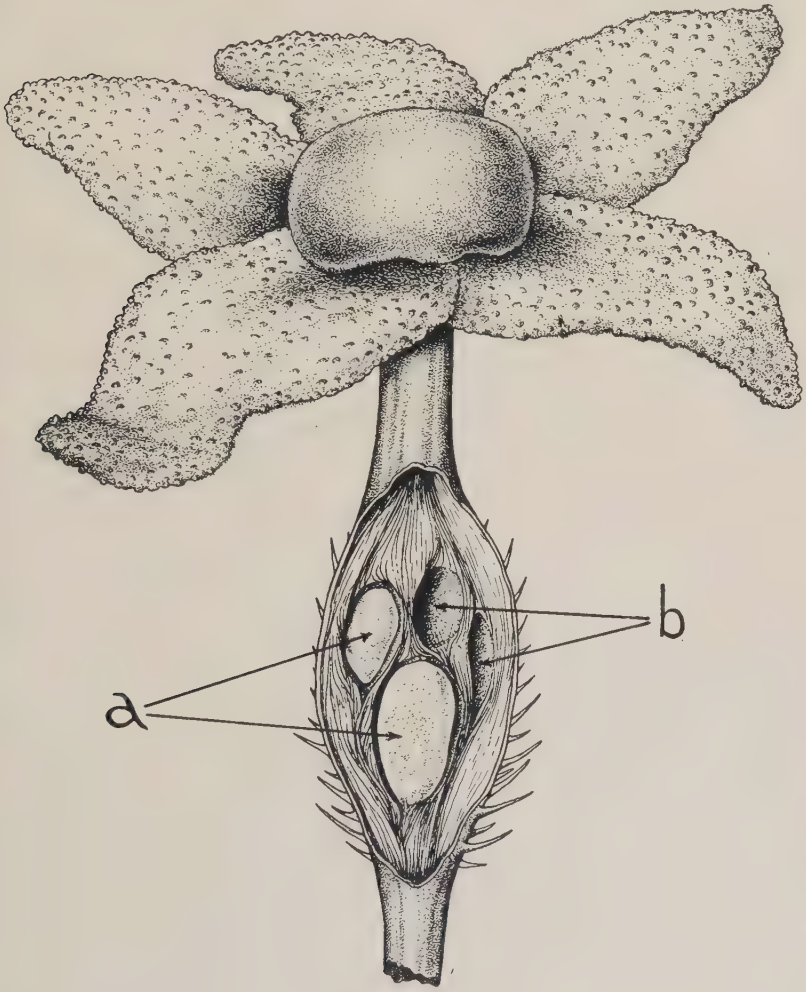

FIG. 2. Gynoecium of *Vaseyanthus insularis: a,* young ovules; *b,* developing vescicles. ×28. (Drawn from isotype.)

(2) The position and number of the seeds, whether proximal or distal. In the latter case, the development of the upper ovule appears to effect an irregular transverse rupture, with the fruit at length separating into two partly open disseminules. (3) Whether the beak or rostrum is persistent or at length deciduous;

its shape. It never appears to separate as a calyptra, for, in cases where it is shed, it does not leave a dehiscently opened fruit, but is choked off by the hardening walls of the basal body of the fruit. (4) The number of stamens, whether constant or variable within a population, appears to have taxonomic value in some cases. (5) The leaves, though highly variable within a population, may within limits, substantiate evidence for segregates as primarily expressed by fruits and stamens. The entities overlap in degree of leaf-dissection, in the character and density of trichomes, in expansion, and in thickness. Much of the variation may be determined by seasonal environmental differences. A moist fertile soil produces a wide, soft, shallowly-lobed leaf of sparse pubescence, while a moisture-impoverished season or situation appears to produce a small blade with dense scabrous trichomes. In spite of these variable factors, however, a certain coordination of leaf characters appears perceptible within the intervariant limits of the phenotypes.

The cupulate or shallowly campanulate corollas with their spreading lobes are rather uniform throughout the genus. They are minute, delicate, and do not lend themselves readily to study in dried specimens. The lobes are broadly linear to triangular, commonly knobby-glandular, the glands colorless or tinged with pink, the latter apparently a physiologic stage not correlative with populations.

With the above characters it would appear feasible to make an adequate taxonomic account of the genus. The 28 available collections seem, however, quite insufficient for a complete treatment. Until more collections are gathered and genetic studies made, perhaps the following segregation of the variants will suffice to prepare the genus for inclusion in Wiggins' forthcoming flora of the Sonoran Desert. It is based on herbarium material loaned by the Herbarium of the University of California in Berkeley and by the Dudley Herbarium of Stanford University, to the curators of which the author expresses his thanks for their cooperation. In addition, the specimens in the herbarium of the Allan Hancock Foundation at the University of Southern California have been studied.

Vaseyanthus Cogn. Zoe 1: 368. 1891.

Small, slender, herbaceous perennial (or annual?) vines with palmately lobed or dissected leaves and small globose or ellipsoid, smooth or echinate fruits. Stems sulcate, commonly pustulate on the angles, pubescent or glabrous, the internodes relatively short; tendrils petiolate, usually bifid; leaves petiolate, commonly hispid-pubescent and variably scabrous with conic trichomes; flowers small, 5-merous, monoecious; calyx-tube generally cupulate or campanulate, the lobes minute; corolla cupulate with spreading lobes; staminate flowers racemose, simple or compound, long-

pedunculate; anthers 3–5, linear, horseshoe-shaped on a column of united filaments; pollen large, smooth, depressed-globose, obscurely 5–6-sulcate; pistillate flowers small, pedunculate, solitary in same axils as the male flowers; calyx and corolla adnate; ovary conic to ovoid, 2–3-celled, long-rostrate; style short, stigma thickened, discoid; ovules one in each cell, erect to ascending, or rarely even horizontal, attached near base of cell, the upper ovule commonly aborting; fruit narrowly ovoid to globose, thickly long-rostrate, the rostrum persistent or deciduous, the body dry, indurate, vesicular, indehiscent or rarely dehiscent, armed or smooth, 1–3-seeded; seeds erect or ascending, obovate or ovoid, somewhat compressed. Type species: *Vaseyanthus Rosei* Cogn.

It is not known if the genus is wholly perennial or partly annual. There are no roots or root-crowns present in the specimens studied. One collector of *Vaseyanthus insularis* has noted, "Vine from a perennial tap-root" (*Annetta Carter et al. 2001*). Cogniaux described *V. Brandegei* as having fibrous roots.

KEY TO THE SPECIES AND VARIETIES

Mature fruits 1 cm. or more in diameter; prickles 4–7 mm. long; stamens 5; leaf lobes rounded to acute, often mucronate (Cape District)	1. *V. Brandegei*
Mature fruits less than 1 cm. in diameter; prickles 2–3 mm. long or lacking; stamens 3–5; leaf lobes not rounded, mucronate to aristate	2. *V. insularis*
Fruit echinate	
Leaves thickish, densely pubescent or scabrous, the lobes mostly triangular, acute, mucronate (peninsular and insular)	2a. *V. insularis var. originalis*
Leaves thin, sparsely pubescent to glabrate, the lobes mostly lanceolate, acuminate, aristate (mainland and San Pedro Nolasco Island	2b. *V. insularis var. Palmeri*
Fruit not echinate (peninsular and insular)	2c. *V. insularis var. inermis*

1. VASEYANTHUS BRANDEGEI (Cogn.) Rose, Contr. U. S. Nat. Herb. 5: 119. 1897. *Echinocystis Brandegei* Cogn. Proc. Calif. Acad. Ser. 2, 3: 59. 1890. *Vaseyanthus insularis Brandegei* (Cogn.) Jtn. Proc. Cal. Acad. Ser. 4, 12: 1182. 1924.

Relatively coarse herbaceous vines with deeply lobate leaves and strongly echinate, globose, indurate fruits; stems coarse, strongly ribbed, hispid, glabrate; tendrils bifid, stoutly long-pedunculate, sparsely hispid near the base; leaves rather thick, orbicular in outline, 2–5 cm. broad, rather densely and strongly hispid below and above, and somewhat muriculate above, 5–7-lobed, with open rounded sinuses, the lobes lanceolate or ovate, or spatulate, mostly rounded, but sometimes acute, often mucronate; petioles from somewhat shorter than to longer than the leaf-lobes, curved-hispid; male flowers in compound racemes, the peduncles mostly shorter than the leaves; flowers numerous;

pedicels glabrous, persistent; corollas white, 5–6 mm. broad; stamens 5; ovary densely echinate, ovoid, with a slender beak; fruit globose, with thick vesicular walls, strongly echinate, pericarp and prickles at base sparsely pilose; body of fruit 12–20 mm. in diam., 2-celled, 1–2-seeded, 1 seed often aborting; prickles mostly 5–7 mm. long; seed compressed, dark brown, obliquely and broadly oval, narrowed at base.

Type locality: "ad Todos Santos" in the Cape District of Baja California, Mexico.

I have not seen the type, its whereabouts being unknown to me. Other specimens examined are: Guadalupe (southern Magdalena Plain), Jan. 17, 1890, *Brandegee s. n.;* San Jose del Cabo, Jan.–March 1901, *Purpus 490;* Espíritu Santo Island, April 1892, *Bryant 230;* San Diego Island, May 27, 1921, *Johnston 3929,* "trailing over cobble stones on beach"; 4 miles south of Guadalupe, March 21, 1935, *Whitehead 840,* "Along beach on sand dunes"; 15 miles south of Rancho Venancio (southern Magdalena Plain), March 21, 1935, *Shreve 7195;* Los Muertos, Cape District, March 5, 1937, *Rempel 78.*

These collections indicate a littoral species, but they do not constitute positive evidence for excluding it from the interior. In this series there is little apparent gradation in the size of the fruits, length of prickles, and number of stamens towards the *V. insularis* complex. The character of the leaf, though not so easily described, shows a definite homogeneity apart from the smaller and more acutely lobed leaf of *V. insularis.* In the lack of intergrades, therefore, the population of *V. Brandegei* appears to have a firm basis for specific segregation.

The existence of *V. Brandegei* on the southern end of the Magdalena Plain I attribute to post-Tertiary migration, subsequent to the joining of the Cape Island and the peninsula in Quaternary times. Hence, *V. Brandegei,* a postinsular endemic, is now migratory.

2. Vaseyanthus insularis (Wats.) Rose, Contr. U. S. Nat. Herb. 5: 120. 1897. *Echinopepon insularis* Wats. Proc. Am. Acad. 24: 51. 1889.

Originally described as annual but probably perennial; stems slender, striate, pustulate on the angles, scabrous-pubescent, curly-pubescent, or puberulent to glabrous; leaves cordate in outline, 2–7 cm. long, 2.5–8 cm. wide, sparsely or densely hispid above and below, in age or adversity becoming scabrous with conical processes, shallowly or deeply 5–9-lobed, the lobes triangular to lanceolate, denticulate, acute to acuminate, mucronate to aristate, the basal sinus broad and open; petioles equaling or much exceeding the blades; male inflorescence racemose with short lateral branches, shorter than or much exceeding the leaves; calyx shallowly campanulate, the teeth green, minute;

corolla 5-cleft, 4–5 mm. broad; stamens 3, 4, or 5, deeply bent; female flowers short-pedunculate, somewhat larger than the male; fruits conic to ellipsoid, the long beak mostly smooth, tardily deciduous or persistent, the body of the fruit globose to ellipsoid, 7–9 mm. in diam., indurate (but slightly so in 1 variety), spongy or vesicular, smooth or covered with straight stiff prickles 1–3 mm. long, 1–2-celled, 1–2-seeded; seed erect, smooth, oblong-obovate in outline, subcompressed, with a broad flat base, 4–5 mm. long.

2a. V. INSULARIS var. **originalis** nom. nov.

Leaves thick, relatively densely pubescent, commonly divided half way to the base or less, the lobes triangular to lanceolate, denticulate to irregularly sub-lobed; body of the fruit globose or oblong, short-echinate; beak apparently finally deciduous, broad at the base, its ovule usually aborting.

Type. San Pedro Mártir Island, *Edward Palmer 409* in 1887.

Specimens examined include an isotype and the following: La Paz, Oct. 1, 1890, *Brandegee 230;* North San Lorenzo Island (Las Animas), June 23, 1921, *Johnston 4195,* "Common, trailing over cobblestones on beach"; Small bay north of Puerto Escondido, ca. 23 km. south of Loreto, Nov. 20, 1947, *Carter et al. 2001,* "Vine from perennial tap root; flowers white; trailing over rocky beach well above high tide line"; San Francisquito Bay, March 30, 1947, *Harbison 41638.* This last is atypical in having nearly glabrous stems and fruits, which condition suggests *V. insularis* var. *Palmeri,* but the small angulate-lobed leaves, the lobes with obtuse tips, is quite unlike that variety.

2b. V. INSULARIS var. **Palmeri** (Wats.) comb. nov. *Echinopepon Palmeri* Wats. Proc. Am. Acad. 24: 52. 1889. *Brandegea Palmeri* (Wats.) Rose, Contr. U. S. Nat. Herb. 5: 120. 1897.

Stems sparsely puberulent to glabrous; petioles slender; leaves thin, sparsely to somewhat densely pubescent, rarely scabrous, commonly divided to below the middle of the blade, the lobes lanceolate, commonly saliently toothed, acute to acuminate, aristate; body of fruit globose, the pericarp sparsely puberulent; prickles 2–3 mm. long, glabrous or glabrate; beak narrow, acute, persistent.

Type. Guaymas, Sonora, *Palmer 304* in 1887.

Besides an isotype studied, the following collections have been examined: collector?, sheet in Herb. of T. S. Brandegee, U.C. Herb., Guaymas, 1893; Guaymas, Sonora, Dec. 17, 1939, *Drouet & Richards 4034,* "trailing over rocks at base of cliffs on mountain"; January 26, 1927, *Marcus E. Jones 22982;* Bahía San Carlos, February 8, 1940, *Dawson 1073;* San Pedro Nolasco Island, April 17, 1921, *Johnston 3132,* "In a gulch near sea, covering rocks and shrubs with a very dense thick mat of stems growing interlaced with no. 3131, a smooth-fruited plant."

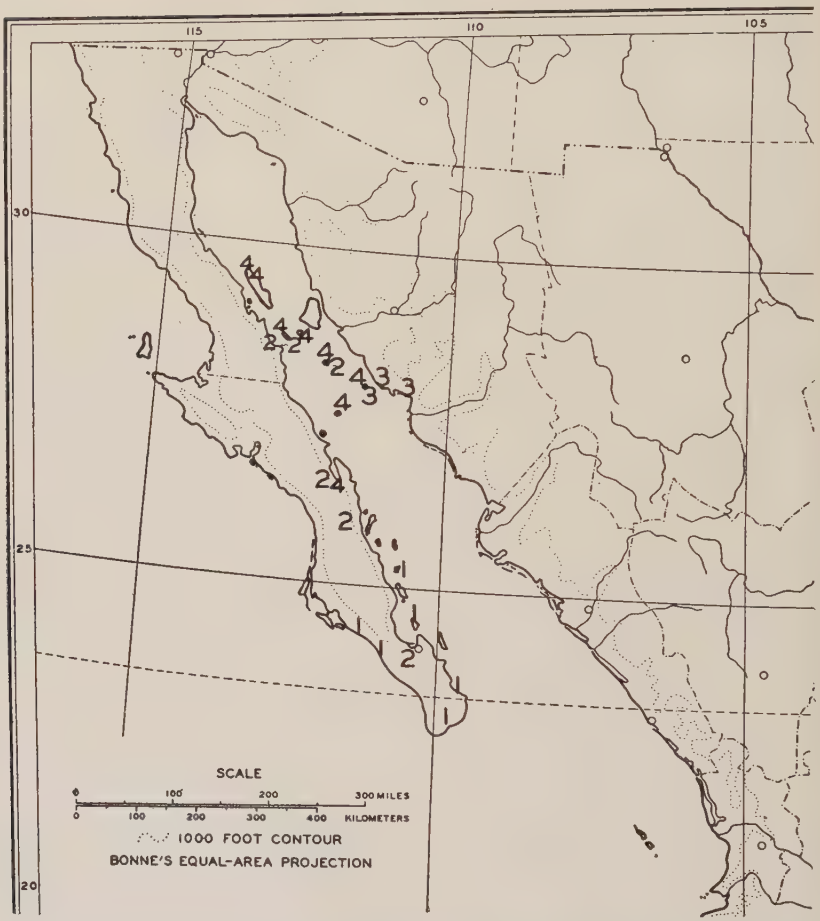

Fig. 3. Distribution of *Vaseyanthus* in the California Gulf Region: 1, *V. Brandegei;* 2, *V. insularis originalis;* 3, *V. insularis Palmeri;* 4, *V. insularis inermis.*

Although not so easily defined, this segregate may be more strongly divergent from *V. insularis* var. *originalis* than is the following smooth-fruited variety.

2c. V. INSULARIS var. INERMIS Jtn. Proc. Cal. Acad., ser. 4, 12: 1182. 1924. *Vaseyanthus Rosei* Cogn. Zoe 1: 368. 1891.

Stems and leaves scabrous-pubescent; leaves small, the dried blades mostly less than 3 cm. broad, broader than long, rarely divided half way to base, commonly shallowly 7–9-lobate, the lobes broad, angulate, obtuse to acute, mucronate to aristate; body of fruit unarmed, either obliquely globose with a persistent

attenuate beak and 1-seeded, or obliquely ellipsoid, and 2-seeded, tardily and irregularly dehiscent around the middle.

Type. Isla Partida (north or south one?), Gulf of California, *Johnston 3224,* April 22, 1921.

An isotype examined notes the variety as "Common on slopes facing sea, especially in steep draws; trailing over shrubs and rocks". It has unusually large leaves, up to 5 cm. broad, with shallow triangular lobes. Another collection by Johnston, without number from the same island, has deeply cut leaves with linear-lanceolate, acuminate lobes. The remaining sheets are rather uniform in their small leaves with shallow triangular lobes: Mejia Island, April 30, 1921, *Johnston 3355,* "trailing over low bushes in an open wash"; Puerto Refugio, Angel de la Guarda Island, January 26, 1940, *Dawson 1024;* Tortuga Island, May 11, 1921, *Johnston 3606,* "Forming dense masses on shrubs, mainly on north and east parts of island. These growths conspicuous from gulf;" San Pedro Nolasco Island, April 17, 1921, *Johnston 3131,* "Growing in dense masses over shrubs and rocks in a gulch near sea"; Tortuga Island, March 17, 1937, *Rempel 221;* Baja California, *Purpus s. n.;* south end of Bahía Concepción, Dec. 1, 1946, *Wiggins 11508* (in part).

The maintenance of this variety rests solely on the non-echinate character of the fruits. Johnston, who studied the plant in the field, has stated (l. c. p. 1181) that plants with smooth fruits in some localities may grow intertwined with those of echinate fruits (e.g. *Wiggins 11508*) and without intergrades, or in other localities he noted vines with fruits furnished with many prickles as well as vines with fruits having very few. I have been unable to perceive other correlative characters to strengthen the variety. The difference may be based on a segregating Mendelian factor and the variety may be really only a form, but without genetic evidence, I defer the obvious taxonomic move. Its distribution appears to be coextensive with *V. insularis* var. *originalis.*

Evolution

The area occupied by *Vaseyanthus* lies in the heart of the unique California Gulf Region. This area, physiographically, has been highly modified during the Tertiary Period, and the relative occupancies of land and sea today bear but little resemblance to what they were in early Tertiary. According to geologic studies (see Schuchert's synthesis, 1935), a sea invasion of the trough got under way in the Oligocene. Previous to that and subsequent to the Cretaceous seas, the present gulf was apparently terra firma. In early Miocene times, the gulf reached to about the latitude of Angel de la Guarda and Tiburón islands. By late Miocene, the gulf appears to have reached its greatest extent, occupying the Colorado Desert and adjacent western Sonora and Arizona. As the peninsula and mainland became

more distantly separated, the salt water barrier surrounded the mid-gulf islands, most of which appear to date from the late Miocene, while the islands near the Cape District and the Cape District itself appear to be older. During late Pliocene and Pleistocene, the modern peninsula arose. Also the shore lines of both coasts advanced with the growth of piedmont attritions, constricting the gulf and leaving it outlined as of today.

It is logical to infer that the growth of the gulf caused extensive disjunctions in plant populations. In species of general distribution, for example, there would have resulted rather numerous isolated populations on the respective islands, on the peninsula, and on the mainland. In a recent paper (1949), I have pointed out the importance of land and sea ratios to the development of the flora in the California Gulf Region. Since isolation has long been a recognized factor in speciation, we may well examine the distribution of *Vaseyanthus* in the light of the physiographic factor. But first let us discuss the dispersal facilities of the genus, since it is possible that the distribution of *Vaseyanthus* is due mainly to its dispersal efficiency and the present occupancies are a modern pattern.

The fruits of *Vaseyanthus* appear well equipped for dissemination by water, wind, or animal transport. They are tough, light in weight, and provided with prickles. Their roundness also conceivably makes them susceptible to rolling by strong winds. The seed is safely (?) protected in a strong vehicle. Altogether, the fruit appears admirably designed to spread the genus widely, but this obviously has not happened. The dispersal facilities appear to have been limited by environmental factors or possibly, by the plant's own physiologic ineptitude, since the related genus, *Echinopepon,* with fruits less proficiently adapted for dispersal, nevertheless at present exploits a wider horizon. The members of *Vaseyanthus* are in large part surrounded by salt water. But, if salt water be a serious barrier, plants on the Cape District have a long northward land path open to them, while those on the mainland theoretically could have extended north or south. Both the occasional seasonal hurricanes and the extinct mammal populations could have served to effect at least sporadic dissemination of seeds in the geologic long past. The areal occupation of the genus does not appear to have been limited by lack of a dispersal mechanism. Although fit for local perpetuation, the fruit characters do not explain the restricted distribution.

Since the genus is now within an area receiving summer rainfall, it is probable that existence is dependent upon some of the conditions inherent in that type of environment. It is apparently barred from more northward occupancy by the conditions attendant on lower winter temperatures and summer droughts. The physiology appears to have been and still to be inadequate

for the occupancy of more than the narrow environmental range encompassed by the shores of the central and southern part of the Gulf of California. However, the physiologic factors cannot show, except through experimental methods, the causes for the confined and disjunct present distributions of the members of the genus. For the purposes of this discussion, therefore, the physiologic potentialities can contribute little, although their possible significance should be kept in mind.

When considering the problem deliberately from the environmental angle, there are developmental factors of special significance. Historically, the environment can be revealingly defined by the physiography. In the area under consideration an eventful, sequential, datable land evolution occurred. It offers strong evidence for interpreting *Vaseyanthus* distributions.

The distribution of *Vaseyanthus* appears to be that of a Tertiary relic. It is closely peripheral to the borders of the early Miocene gulf, when northern limits of that body of water reached only to about the middle of the present gulf. Discounting the more remote possibility of dispersion via sea water, the spotted occurrences on islands, peninsula, and mainland appear to represent remnants of a general distribution in the early or middle Tertiary anterior to the gulf invasion. This is particularly true of the *Vaseyanthus insularis* complex, since *V. Brandegei* occupies the older insular area represented by the Cape District, as will be discussed later.

Reasoning from this basis, the distinct populations of *Vaseyanthus insularis* more or less started their divergent tendencies in the Miocene period. If so, the rate of speciation has been surprisingly slow. Not a single clear-cut species appears to have evolved in the 15 to 20 million years estimated to have elapsed (year estimate based on that as in Schuchert & Dunbar, 1947, pp. 64–71). Evolution of the disjuncts has at present reached the varietal or subspecies stage. Judging from the unstable tendencies of the stamens and ovarian cells, one would suppose it to be a complex in genetic flux, for which only the random segregation in a varying environment was needed for the genesis of new species (cf. Turesson, 1922). However, in this connection, it is also well to remember that morphological instability in floral parts is common in genera known to be very old, e.g., *Nymphaea, Distylium, Magnolia,* etc., so that floral lapses in *Vaseyanthus* may be indicative of an old genus. In the disjunctive situation of *Vaseyanthus,* there was obviously lacking the necessary genetic coherency for any variant to diverge apprecibly along independent lines. Genetic studies might determine the mechanics of this failure. So far as we know the complex today, the net result has been the development of a variety on the mainland, and two varieties coinhabiting the islands and the peninsular gulf shore.

Physiographically, the case of *Vaseyanthus Brandegei* is just as clear. Except for recent minor extensions, it is confined to the Cape District of the peninsula and adjacent gulf islands, which are part of the same basic granitic monolith. Until most recently, the cape was a well isolated island, apparently dating from the early Tertiary (Gentry, 1949, pp. 81–98). The separate specific status of *Vaseyanthus Brandegei* is therefore neatly correlated with its long isolation from other members of the genus. Morphologically and genetically, it appears to be a stable species. Under a relatively constant insular and oceanic type of climate, it has long been environmentally secure. Just as *V. insularis* appears to express, through morphological vagaries, the dynamics of changing land forms, so *V. Brandegei* indicates an insular constancy through its morphological unity.

Thus we have two lines of evidence for the evolution of *Vaseyanthus:* from morphology and physiography. Morphologically, its species have had a common ancestor with those of *Echinopepon. Vaseyanthus* has diverged more in developing the hardened, vesicular 1-seeded fruits and in the tendency to drop stamens, while *Echinopepon* has evolved further by the development of more species and by the greater variation of its perianth and trichomes. *Vaseyanthus insularis* is more modified than *V. Brandegei* in its smooth-fruited variety and the tendency to drop stamens.

Geologically, the evidence indicates that the evolution of land forms had a great deal to do with specific divergence in *Vaseyanthus.* It is surmised that early in the Tertiary, a common ancestor of the *Vaseyanthus* species occupied the California Gulf Region. The invading Tertiary gulf isolated segments of the population: first that of *V. Brandegei* on the Cape District island in early Tertiary times; second, the population of *V. insularis,* was cut into many small populations on either side of the gulf and on the islands within the gulf, in mid-Tertiary. These segregations may have been interrupted by subsequent land resurgence with attendant remixing of plant populations, but in the long run, the segregations allowed opportunity for expression of genetic differences. The differences, as of today, are perceptible in taxonomic varieties. Because segregation of *V. Brandegei* and *V. insularis* dates from the early Tertiary to Recent, it appears to have required most of the Tertiary to develop specific status, and because the *V. insularis* population became disjunct in the Miocene, it appears to have required about one third of the Tertiary to engender varieties in this genus.

Tentatively, the taxonomy is supported by the physiography and vice versa. However, I do not wish to leave the reader with the impression that either line of evidence is erected to support the other, but both together form a hypothesis fit to be tested with studies of other genera. Concommitantly, more exhaustive geologic field studies are badly needed. The hypothesis is that

evolution of life forms is correlative with the evolution of land forms in the California Gulf Region and that plant speciation in some cases can be synchronized somewhat with geologic time.

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ON THE SUBSPECIES OF LEPIDIUM MONTANUM

C. Leo Hitchcock

In the fall of 1945, Mr. R. C. Barneby sent me a series of specimens of a shrubby *Lepidium* which he and Mr. Ripley had collected twelve miles south of Mountain Home, Elmore County, Idaho. I ventured the opinion that the collection comprised another variant of the plastic *L. montanum* Nutt. ex T. & G. and with this opinion Mr. Barneby agreed. However, in the fall of 1947, he sent me a second series of plants collected near Duchesne, Duchesne County, Utah, which were more similar to the specimens from Idaho than to any other of the various subspecific entities of *L. montanum*. After studying the two collections I believe them to be sufficiently distinctive to warrant description.

Accordingly, these two shrubby-based, dwarf plants were described as new subspecific entities of *L. montanum* and a key was

prepared to differentiate them from var. *integrifolium* and the other varieties of *L. montanum*. Therefore, Dr. Rollins' (1948) paper "On Two Perennial Caespitose Lepidiums of Western North America" was of particular interest to me since *L. Davisii* Rollins, therein described (type: from ca. fourteen miles south of Mountain Home, Elmore County, Idaho, June 27, 1946, *R. J. Davis 4670*), is the same entity as that collected by Ripley and Barneby in nearly the same locality in 1945.

Dr. Rollins is of the opinion that his species is comparatively closely related to *L. nanum* and that it partially bridges the gap between that species and *L. montanum*. To substantiate this opinion he states that "the siliques of *L. Davisii* are similar in shape to those of *L. nanum*. The seeds are of similar size and shape, and the cotyledons are accumbent in both species." With Dr. Rollins' conclusions I am unable to agree, since, in my opinion *L. Davisii*, with its entire leaves, is even less similar to *L. nanum* than are several of the forms of *L. montanum*. *Lepidium nanum* is unique, insofar as North American species are concerned, in having apically trilobed leaves and in being scapose. For this reason, I suggested (1936, p. 314) not that *plants*, but rather that the *habit* of plants of *L. nanum* was "more suggestive of *Draba* than of *Lepidium*." *Lepidium Davisii*, on the other hand, is so similar to occasional stunted plants of *L. montanum* (*sensu latiore*) from New Mexico or Utah (e.g. *Hitchcock et al 4316*) as to be distinguishable from them with some little difficulty. Furthermore, the cotyledons of *L. montanum*, *L. nanum*, and *L. Davisii* are all incumbent [according to the definition of "incumbent" as applied to cotyledons by Gray (1887, p. 128, figs. 427, 428) and Jackson (1928)]. This is the normal condition in *Lepidium*.

In my opinion, *L. Davisii* is not specifically distinct from *L. montanum*. In the following revised key to the subspecies of *L. montanum* having entire or non-lobed leaves, *L. Davisii* is included as a subspecies.

Leaves entire to crenate-dentate.
  Basal leaves crenate or crenate-serrate .... *L. montanum* subsp. *spathulatum*
  Basal and cauline leaves entire.
    Plants with branched, woody crowns; stems many, 5–10 cm. tall, erect; basal leaves linear to oblanceolate, 10–40 mm. long, 1–4 mm. broad.
      Basal leaves linear to linear-spatulate, 20–40 mm. long, 1–2 mm. broad, glabrous or nearly so, cauline leaves similar but smaller; petals cream-colored ..... *L. montanum* subsp. *demissum*
      Basal leaves spatulate to oblanceolate, 10–20 mm. long, 2–4 mm. broad, sparsely puberulent, cauline leaves somewhat larger; petals white ..... *L. montanum* subsp. *Davisii*
    Plants with thick, unbranched caudex; stems decumbent at the base, 10–30 cm. tall; basal leaves thick and fleshy, 30–100 mm. long, 4–15 mm. broad ..... *L. montanum* subsp. *integrifolium*
Leaves, some of them, lobed to parted or divided . . . , etc.

Since the publication of the numerous varieties of *L. montanum* in 1936, I have come to believe that they might more truly be de-

fined as subspecies, as most present day workers interpret that entity, and I therefore propose the following new names.

LEPIDIUM MONTANUM Nutt. ex T. & G. subsp. **demissum** subsp. nov. Plantae glabrae vel sparse pubescentes, demissae; caulibus 4–10 cm. altis, erectis, ex caudicibus ramosissimis; foliis integris, linearibus vel spathulatis, 20–40 mm. longis, 1–2 mm. latis; racemis elongatis; petalis albo-flavis.

Plants glabrous or very sparsely pubescent, from thick, woody, freely branching crowns; stems many, stiffly erect, 4–10 cm. tall; leaves entire, linear to very narrowly linear-spatulate, the basal mostly 20–40 mm. long, 1–2 mm. broad; racemes about half total length of stems; petals cream-colored.

Type. White shale benches and hilltops at 5900 feet elevation, 4 miles southwest of Duchesne, Duchesne County, Utah, June 15, 1947, *Ripley & Barneby 8699* (Univ. of Washington Herbarium 113909).

The short stature of these plants apparently is not due to particularly poor growing conditions during the season of 1947. They presumably are derived from subsp. *integrifolium* which is to be found in the same locality in moister places, especially where the salinity is high. Since numerous plants were collected, it is certain that the type is representative of a distinctive population.

LEPIDIUM MONTANUM Nutt. ex T. & G. subsp. **Davisii** (Rollins) comb. nov. *L. Davisii* Rollins, Madroño 9: 164. 1946.

Plants similar in habit to those of subsp. *demissum,* the stems many, 3–10 cm. tall, from woody, freely branched crowns, the entire plant finely puberulent; leaves linear-oblanceolate to oblanceolate, entire, the basal smaller than the cauline, the latter 10–25 mm. long, 2–5 mm. broad; stamens 6; petals apparently white.

Material seen. 12 miles south of Mountain Home, Elmore County, Idaho, May 31, 1945, elevation 2750 feet, "plants forming a pure association in dry bed of a small playa on a sagebrush mesa", *Ripley and Barneby 6499;* dried up pond, west of highway ½ mile north of rim of Snake River Canyon, south of Mountain Home (Range 6 E., Township 5 S.), June 27, 1946, *R. J. Davis 4670* (type of *L. Davisii,* Dudley Herbarium no. 314343); from nearly same station, May 9, 1947, *R. J. Davis 4745* (Dudley Herbarium).

In my opinion this phase of the species is also similar to, but apparently more than, a badly stunted form of subsp. *integrifolium.* It is very unlike either subsp. *typicum* or subsp. *papilliferum,* the only subspecies of *L. montanum* previously reported from Idaho, and occurs considerably farther to the north than subsp. *integrifolium* has been reported.

LEPIDIUM MONTANUM subsp. **typicum** nom. nov. *L. montanum* var. *typicum* C. L. Hitchc. Madroño 3: 302. 1936.

LEPIDIUM MONTANUM subsp. *typicum* var. **wyomingense** (C. L. Hitchc.) comb. nov. *L. montanum* var. *typicum* forma *wyomingense* C. L. Hitchc. *op. cit.*, p. 304.

LEPIDIUM MONTANUM subsp. **canescens** (Thell.) comb. nov. *L. montanum* var. *canescens* (Thell.) C. L. Hitchc. *op. cit.*, p. 304.

LEPIDIUM MONTANUM subsp. **cinereum** (C. L. Hitchc.) comb nov. *L. montanum* var. *canescens* forma *cinereum* C. L. Hitchc. *op. cit.*, p. 306.

LEPIDIUM MONTANUM subsp. **papilliferum** (Henderson) comb. nov. *L. montanum* var. *papilliferum* Henderson, Bull. Torrey Bot. Club 27: 342. 1900.

LEPIDIUM MONTANUM subsp. **heterophyllum** (Wats.) comb. nov. *L. montanum* var. *heterophyllum* (Wats.) C. L. Hitchc. *op. cit.*, p. 307.

LEPIDIUM MONTANUM subsp. **glabrum** (C. L. Hitchc.) comb. nov. *L. montanum* var. *glabrum* C. L. Hitchc. *op. cit.*, p. 307.

LEPIDIUM MONTANUM subsp. **alpinum** (Wats.) comb. nov. *L. montanum* var. *alpinum* Wats. Bot. King Exp. 29. 1871.

LEPIDIUM MONTANUM subsp. **tenellum** (Williams) comb. nov. *L. montanum* var. *tenellum* (Williams) C. L. Hitchc. *op. cit.*, p. 308.

LEPIDIUM MONTANUM subsp. **Jonesii** (Rydb.) comb. nov. *L. montanum* var. *Jonesii* (Rydb.) C. L. Hitchc. *op. cit.*, p. 309.

LEPIDIUM MONTANUM subsp. **alyssoides** (Gray) comb. nov. *L. montanum* var. *alyssoides* (Gray) Jones, Zoe 4: 266. 1893.

LEPIDIUM MONTANUM subsp. **alyssoides** var. **Eastwoodiae** (Wooton) comb. nov. *L. montanum* var. *Eastwoodiae* (Wooton) C. L. Hitchc. *op. cit.*, p. 311.

LEPIDIUM MONTANUM subsp. **spathulatum** (Robinson) comb. nov. *L. montanum* var. *spathulatum* (Robinson) C. L. Hitchc. *op. cit.*, p. 312.

LEPIDIUM MONTANUM subsp. **angustifolium** (C. L. Hitchc.) comb. nov. *L. montanum* var. *angustifolium* C. L. Hitchc. *op. cit.*, p. 312.

LEPIDIUM MONTANUM subsp. **integrifolium** (Nutt.) comb. nov. *L. montanum* var. *integrifolium* (Nutt.) C. L. Hitchc. *op. cit.*, p. 313.

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NEW COMBINATIONS IN HYMENOXYS

K. F. Parker

Inasmuch as the species upon which the genus *Actinea* was based (*A. heterophylla*) has proven to belong to the genus *Helenium,* it is necessary to utilize *Hymenoxys* Cass., the next available name, for those other entities formerly placed under *Actinea.* The following new combinations, proposed in a monograph of the genus, are presented at this time in order to make the names immediately available to other workers who may wish to use them. Complete synomymy is included in the forthcoming monograph.

1. **Hymenoxys Torreyana** (Nutt.) comb. nov. *Actinella Torreyana* Nutt. Trans. Am. Philos. Soc. II, 7 : 379. 1841.

2. **Hymenoxys acaulis** (Pursh) comb. nov. *Gaillardia acaulis* Pursh, Flora Am. Sept. 2 : 743. 1816, as *Galardia.*

3. Hymenoxys acaulis (Pursh) Parker var. **glabra** (A. Gray) comb. nov. *Actinea scaposa* Nutt. var. *glabra* A. Gray, Man. Bot. N. U. S. ed. 5 : 263. 1867.

4. Hymenoxys acaulis (Pursh) Parker var. **arizonica** (Greene) comb. nov. *Tetraneuris arizonica* Greene, Pittonia 3 : 266. 1898.

5. Hymenoxys acaulis (Pursh) Parker var. **caespitosa** (A. Nels.) comb. nov. *Tetraneuris acaulis* (Pursh) Greene var. *caespitosa* A. Nels. Bot. Gaz. 28 : 127. 1899.

6. Hymenoxys acaulis (Pursh) Parker var. **Ivesiana** (Greene) comb. nov. *Tetraneuris Ivesiana* Greene, Pittonia 3 : 269. 1898.

7. **Hymenoxys scaposa** (DC.) comb. nov. *Cephalophora scaposa* DC. Prodromus 5 : 663. 1836.

8. Hymenoxys scaposa (DC.) Parker var. **linearis** (Nutt.) comb. nov. *Actinella scaposa* Nutt. var. *linearis* Nutt. Trans. Am. Philos. Soc. II. 7 : 379. 1841.

9. **Hymenoxys argentea** (A. Gray) comb. nov. *Actinella argentea,* A. Gray, Plant. Fendl. 100. 1849.

10. **Hymenoxys Brandegei** (Porter) comb. nov. *Actinella Brandegei* Porter ex A. Gray, Proc. Am. Acad. 13 : 373. 1878.

11. **Hymenoxys grandiflora** (Torr. & Gray) comb. nov. *Actinella grandiflora* Torr. & Gray, Bost. Jour. Nat. Hist. 5 : 109. 1845.

12. **Hymenoxys Bigelovii** (A. Gray) comb. nov. *Actinella Bigelovii* A. Gray, Plant. Wright. 2 : 96. 1852.

13. Hymenoxys Richardsonii (Hook.) Ckll. var. **floribunda** (A. Gray) comb. nov. *Actinella Richardsonii* Hook var. *floribunda* A. Gray. Plant. Fendl. 101. 1849.

14. Hymenoxys Cooperi (A. Gray) Ckll. var. **canescens** (D. C. Eaton) comb. nov. *Actinella Richardsonii* Hook. var. *canescens* D. C. Eaton in Watson, King Geol. Expl. 40th Par. 5 : 175. 1871.

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REVIEW

Woody Plants of the Western National Parks. By Virginia Long Bailey and Harold Edwards Bailey. American Midland Naturalist Monograph No. 4, February 1949. University of Notre Dame, Notre Dame, Indiana. 274 pp., 146 figs., cloth. $4.00.

Visitors to these sixteen national parks who would like to have one book which will enable them to identify the woody plants will welcome this botanically accurate handbook written in non-technical language. Keys to both trees and shrubs are given, but only shrubs are described in the text as the section on trees has been previously published (Bailey & Bailey, Forests and Trees of the Western National Parks. U.S.D.I., Conservation Bulletin No. 6, 1941). Although the emphasis is on common names, scientific names by species, genera, and families are included. The underlying taxonomy, based on the authors' own research and their interpretation of recent monographs, is conservative and sound. Frequent reference is made in the discussion to varieties and forms and to their distinguishing characters. While in the employ of the National Park Service, the authors carried on extensive field work in these parks and became familiar with the interests of the public. Following the usage of the National Park Service, the authors have, where practicable, adopted the nomenclature of "Standardized Plant Names" prepared for the American Joint Committee on Horticultural Nomenclature (1942).

Following the concise introduction, each of the sixteen parks is briefly characterized and the dominant trees and shrubs of each altitudinal zone are given for each. The inclusion of Isle Royale in a book on western parks may be criticized by some, even though it does have some plants in common with the more northern of the western parks. Its inclusion, however, results in the addition of many eastern species which will make the book more generally useful than its title indicates.

The abundance of each shrub in each park is given, together with the altitude and particular localities at which it may be sought. For many species, interesting facts are given, such as the origin of the name, the conditions under which the plant grows, uses made of it by Indians, the value of the flowers for honey, of the fruit for food, of the foliage for browse, and of the wood for fuel. Of the 560 shrubs (in 48 families), 145 are illustrated by excellent original line drawings by Mrs. Bailey.

Although many, including the reviewer, will regret the apparent small size of the type, the publishers are to be congratulated upon the format and attractive appearance of the book. The dark blue cover is in conformity with other monographs of the series.—Mary L. Bowerman, Department of Botany, University of California, Berkeley.